U.S. Department of Energy
Categorical Exclusion Determination Form

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Project Title: 25A5144 - Cyanobacteria Designed for Solar-Powered Highly Efficient Production of Biofuels

Location: *- Multiple States - Arizona, North Carolina

Proposed Action or Project Description: American Recovery and Reinvestment Act: ☒

The transformative concept of this research program is to use cyanobacteria as biocatalysts using solar energy and CO2 to produce fatty acids that the cyanobacteria secrete, without major increases in cyanobacterial biomass. Fatty acids are then used for fuel production. Therefore, a major part of the absorbed solar energy and fixed CO2 will be used for fuel production rather than for biomass production, and energy losses are kept to a minimum. This research program will yield a path toward very efficient solar energy conversion to fuel, and at scale will have a significant impact on environmentally responsible, domestic production of liquid transportation fuels. In this project we will utilize metabolic engineering to maximize fatty acid production and secretion in the cyanobacterium Synechocystis sp. PCC 6803 and minimize the energy diverted to the growth of the organism by using cultures that ideally are in stationary phase but that remain physiologically competent. Efficient fatty acid production is then partnered with technologies that efficiently transform these fatty acids into liquid transportation fuels. This represents a paradigm shift in biofuels production from photosynthetic microorganisms as the current production mechanism relies on the harvest of the entire organism and the extraction of the lipid content, leaving the non-lipid biomass (the growth product that we seek to eliminate). Our experimentally supported concept, eliminating major biomass production, enables the highly efficient conversion of solar energy into biofuel compatible feedstock with

Categorical Exclusion(s) Applied:

X - B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects

*-For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, see Subpart D of 10 CFR10 21 Click Here

This action would not: threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive Orders; require siting, construction, or major expansion of waste storage, disposal, recovery, or treatment facilities, but may include such categorically excluded facilities; disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; or adversely affect environmentally sensitive resources (including but not limited to those listed in paragraph B.(4)) of Appendix B to Subpart D of 10 CFR 1021). Furthermore, there are no extraordinary circumstances related to this action that may affect the significance of the environmental effects of the action; this action is not "connected" to other actions with potentially significant impacts, is not related to other proposed actions with cumulatively significant impacts, and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211.

Based on my review of information conveyed to me and in my possession (or attached) concerning the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: /s/ William J. Bierbower Digitally signed by William J. Bierbower DN: cn=William J. Bierbower, o, ou, email=william.bierbower@hq.doe.gov, c=US Date: 2009.12.18 12:02:46 -05'00' Date Determined: 12/18/2009

Comments: Webmaster:

concept, eliminating major biomass production, enables the highly efficient conversion of solar energy into biofuel-compatible feedstock with efficiencies that are expected to be closer to the maximal theoretical limit of 28%. The combination of secretion of fatty acids and eliminating biomass production, yields a much more economical and environmentally responsible path toward biofuel production than can be accomplished by traditional methods. Our proposal for development and optimization of cyanobacteria as photobiocatalysts for solar-powered CO2 reduction and fuel production represents a critical step forward in the efficient production of renewable biofuels by photosynthetic microorganisms. Cyanobacteria are excellent organisms for the production of carbon-neutral and sustainable biofuel. Unlike the vast majority of algae, the genome of Synechocystis is relatively easy to manipulate, and the absence of organellar compartmentation simplifies metabolic engineering efforts. Cyanobacteria are efficient at converting solar energy into lipids, and unlike energy crops, they can be grown on non-arable land. Our team of researchers and collaborators includes Arizona State University with extensive experience in metabolic engineering and physiology of Synechocystis as well as in photobioreactor technologies, North Carolina State University with experience in conversion of lipids into gasoline, diesel, and jet fuel, Diversified Energy with experience in developing photobioreactor and translation technologies for renewable photosynthesis-based fuels, and The Dial Corporation, with extensive experience and knowledge in the translation and processing of lipids and fatty acids. This team represents a set of highly competent scientists and engineers that can advance the key technologies required for implementation. This team also offers an early path to market for renewable fatty acid production that may go beyond the biofuels market and that may include production of high-value, renewable fatty acid feedstock for renewable, green personal care products at a reasonable scale. The personal care products market in turn may represent a gateway industry to advance the systems development and optimization required for the ultimate biofuels market that operates at much larger scale. In this way, responsible and economically feasible scale-up to levels that may significantly impact transportation fuel markets may be accomplished.